

## ***American Recovery and Reinvestment Act*** **Biomass Program Investments**

*The Biomass Program has awarded about \$718 million in American Recovery and Reinvestment Act (Recovery Act) funds.<sup>1</sup> The projects the Program is supporting are intended to*

- Accelerate advanced biofuels research, development, and demonstration
- Speed the deployment and commercialization of advanced biofuels and bioproducts
- Further the U.S. bioindustry through market transformation and creating or saving a range of jobs.

### **\$509 Million for Pilot- and Demonstration-Scale Integrated Biorefineries**

The Biomass Program selected 18 projects under a funding opportunity announcement in December 2009. These projects include 2 research-and-development-scale efforts to complete preliminary engineering design for \$2.5 million each, 12 pilot-scale projects for \$18 million to \$25 million each, and 4 demonstration-scale projects for \$50 million each.<sup>2</sup> These geographically and technically diverse projects aim to validate integrated biorefinery technologies that could produce advanced biofuels, bioproducts, and heat and power in an integrated system. For example, these projects intend to demonstrate

the production of cellulosic ethanol, renewable diesel, and jet fuel, as well as other fuels and products.

Our integrated biorefinery projects funded through the *Recovery Act* are slated to be operational at the pilot and demonstration scale in the next three years. These integrated biorefineries will use domestically collected or produced biomass to sustainably generate a range of different biofuels, helping to reduce our dependence on petroleum-based transportation fuels and chemicals. Pilot-level projects seek to validate the first integration of technologies and are intended to allow for greater scale up. Demonstration-level projects aim to provide data to help enable our partner companies to secure financing for commercial-scale replications. They are also intended to facilitate the development of an advanced biofuels industry with the capacity to meet federal Renewable Fuel Standard (RFS) volumetric requirements for all advanced biofuels, which increase from 1 billion gallons per year (bg) in 2010 to 21 bg in 2022.<sup>3</sup>

### **\$82 Million for a Commercial-Scale Biorefinery Project**

The Biomass Program plans to use about \$82 million of *Recovery Act* funds on an existing biorefinery



project—specifically, to expedite its construction phase and to reduce risks associated with first-of-a-kind deployment. This investment will help ensure the project's planned start-up and commissioning in March 2011.<sup>4</sup>

### **\$107 Million for Fundamental Research in Key Program Areas**

The Biomass Program is investing about \$107 million of *Recovery Act* funds to support competitively awarded projects that aim to develop cutting-edge conversion technologies—including generating more desirable catalysts and fuel-producing microbes—as well as feedstocks.

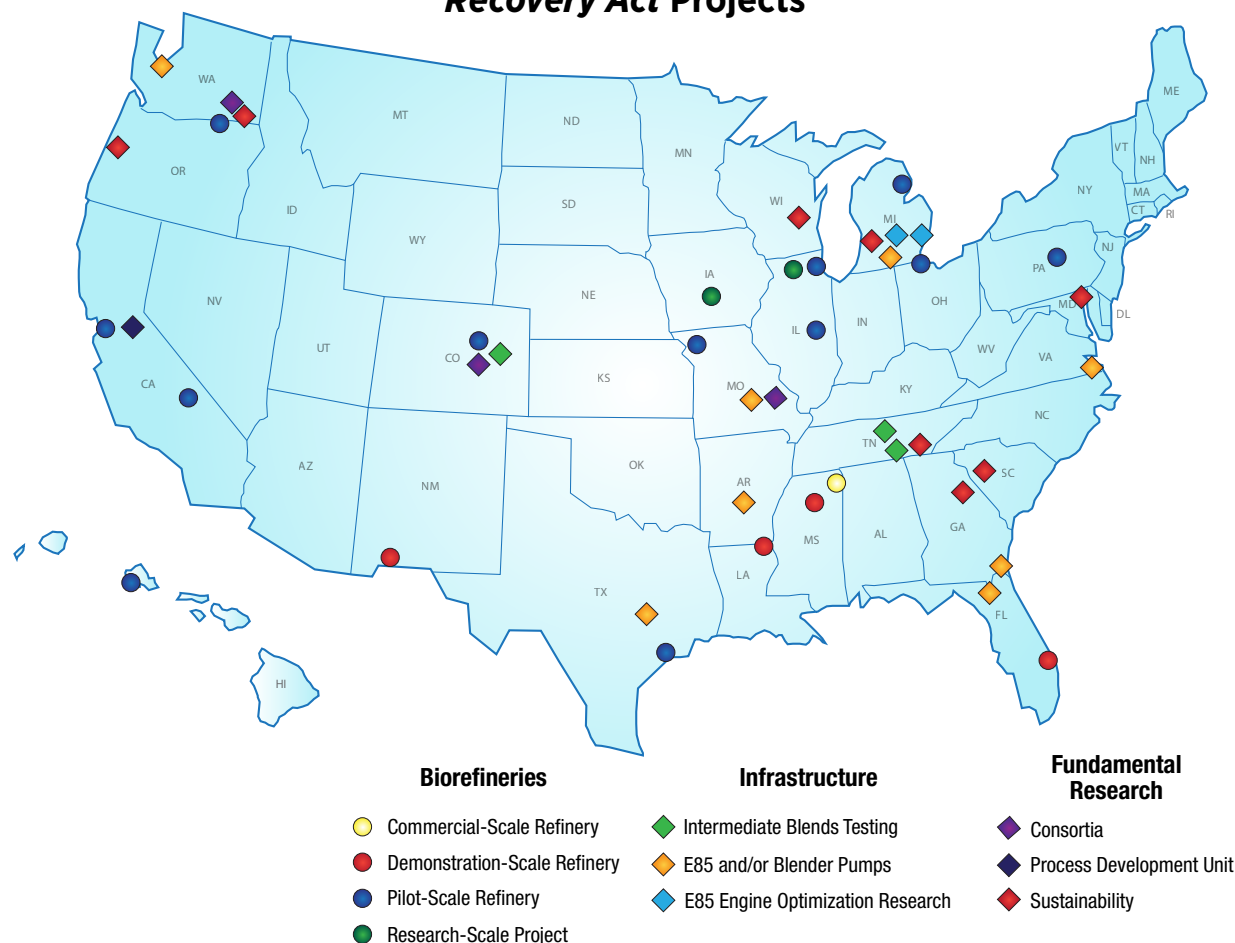
<sup>1</sup> Congress originally appropriated \$800 million to the Biomass Program. \$13.4 million was directed to expand the Integrated Biorefinery Research Facility at the National Renewable Energy Laboratory. Of the nearly \$787 million remaining available for Biomass projects, nearly \$69 million was directed to support Small Business Innovation Research/Small Business Technology Transfer programs and departmental staffing, management, and oversight activities.

<sup>2</sup> The funding amounts described here are DOE contributions. These projects are in addition to six current projects at demonstration-scale that the Program supports.

<sup>3</sup> The 2022 Renewable Fuel Standard volumetric requirement for all renewable fuels is 36 bg.

<sup>4</sup> This project is in addition to four current projects for commercial-scale plants that the Program supports.

## Recovery Act Projects



These investments by the Biomass Program also include sustainability evaluations and process demonstrations and involve about 50 university, industry, and laboratory partners.

- \$49 million for an algal biofuels consortium to develop and demonstrate the science and technology necessary to significantly increase production of algal biomass and lipids, efficiently harvest and extract algae and algal products, and establish valuable conversion routes to fuels and co-products. These activities intend to help researchers and companies overcome several key barriers related to feedstock supply and logistics and conversion to reduce costs of algal biofuels.
- \$35 million for an advanced biofuels consortium to investigate six technology pathways, including biochemical, thermochemical, and hybrid technologies to produce biofuels compatible with today's transportation infrastructure, or “drop-in” fuels. The consortium will conduct cross-cutting research on feedstock logistics, pretreatments, separations, upgrading, engineering and sustainability analysis, and refinery integration. It will then select the most promising pathways to further develop the technologies to produce renewable gasoline, diesel, and jet fuel.
- More than \$5 million to expand resources available for sustainability research, including five projects to
  - Evaluate nutrient and carbon cycling, as well as water quality, under a range of biofuels production systems
  - Understand hydrologic impacts of growing and harvesting short-rotation woody crops
  - Develop a comprehensive framework enabling the analysis of biomass cropping in reference to land-use requirements and competition, environmental consequences, and competing energy technologies.

## Biomass Program Recovery Act Highlights

- More than 35 projects ranging from \$200,000 to \$50 million, representing at least 20 recipient states
- More than 65 industry, university, laboratory, and state partners
- Cost shares required for a majority of project recipients
- An overall investment that represents more than three times the program's recent annual appropriations
- A minimum estimated 2,600 jobs created or saved over the 2009–2014 period

## Integrated Biorefineries and Locations

### *Preliminary Engineering Design*

- Elevance Renewable Sciences in Newton, Iowa
- Gas Technology Institute in Des Plaines, Illinois

### *Pilot Scale*

- Algenol Biofuels, Inc. in Freeport, Texas
- American Process, Inc. in Alpena, Michigan
- Amyris Biotechnologies, Inc. in Emeryville, California
- Archer Daniels Midland in Decatur, Illinois
- ClearFuels Technology in Commerce City, Colorado
- Haldor Topsoe, Inc. in Des Plaines, Illinois
- ICM, Inc. in St. Joseph, Missouri
- Logos Technologies in Visalia, California
- Renewable Energy Institute International in Toledo, Ohio
- Solazyme, Inc. in Riverside, Pennsylvania
- UOP, LLC in Kapolei, Hawaii
- ZeaChem, Inc. in Boardman, Oregon

### *Demonstration Scale*

- BioEnergy International in Lake Providence, Louisiana
- Enerkem in Pontotoc, Mississippi
- INEOS New Planet Bioenergy, LLC in Vero Beach, Florida
- Sapphire Energy, Inc. in Columbus, New Mexico

### *Commercial Scale*

- BlueFire Ethanol, Inc. in Fulton, Mississippi

## Biofuel Consortia

- National Alliance for Advanced Biofuels and Bioproducts, led by Donald Danforth Plant Science Center in St. Louis, Missouri, with more than 30 other academic, industry, and U.S. Department of Energy (DOE) laboratory partners
- National Advanced Biofuels Consortium, led by National Renewable Energy Laboratory (NREL) in Golden, Colorado, and Pacific Northwest National Laboratory (PNNL) in Richland, Washington, with more than 15 academic, industry, and other DOE laboratory partners

## Advanced Biofuels Process Development Unit User Facility

- Lawrence Berkeley National Laboratory in Berkeley, California

## Sustainability Collaborations

- Great Lakes Bioenergy Regional Center working with PNNL, Oak Ridge National Laboratory (ORNL), and university partners in Michigan, Wisconsin, and Ohio on soil carbon dynamics, water quality and direct greenhouse gas fluxes, and land-use change modeling
- ORNL working with the Forest Service at the Savannah River South Carolina site, University of Georgia, and Oregon State University on the hydrologic impact of woody biomass utilization

## Intermediate Blend Testing

- ORNL and NREL evaluating a range of impacts of intermediate blends

## Expanded Fueling Infrastructure for Ethanol Blends

- Multiple locations in the states of Arkansas, Florida, Georgia, Michigan, Missouri, Texas, Virginia, and Washington all received funds to modify about 50 total pumps to dispense higher ethanol blends

## E85 Engine Optimization

- General Motors in Detroit, Michigan, and Bosch in Farmington Hills, Michigan



- Nearly \$18 million to establish a process development unit for national laboratories, academia, and industry partners to demonstrate advanced biofuels processes—and to provide maximum flexibility for scale-up of multiple routes to produce a variety of biofuels. This user facility intends to enable the translation of a range of technologies from laboratory scale to applied demonstrations in its operation. Its planned capabilities include

- Unique pretreatment of biomass
- Enzyme production
- Fermentation to several fuels
- Product purification in quantities sufficient for engine testing at partner institutions.

### More Than \$19 Million for Research Optimizing Ethanol Use and Supporting Its Infrastructure

The Biomass Program has awarded

- About \$16 million to evaluate the impact of higher ethanol blends on a range of conventional vehicles—including small engines and off-road vehicles—for emissions, catalyst temperature, durability and fuel economy, as well as materials and infrastructure component compatibility
- Nearly \$3 million for engine optimization to improve the

performance of flex-fuel vehicles operating on E85

- More than \$1 million to modify several existing retail fueling stations with pumps—and associated infrastructure such as storage tanks, hoses, and piping monitoring systems—to dispense ethanol blends up to E85.

### Project Management, Oversight, and Reporting

The Program has experienced a substantial increase in activity as a result of new *Recovery Act* financial assistance awards, coupled with the required accelerated funds distribution and expenditure timeframes.

To manage and oversee our *Recovery Act* portfolio, we have extended, enhanced, and integrated the well-established, graded approach we use for our traditional project portfolio. We have also continued to ensure that proper selection, monitoring, and assessments are conducted.

In addition, the *Recovery Act* includes considerable commitments to transparency and accountability, and as such requires DOE recipients to report certain information to the Office of Management and Budget via [FederalReporting.gov](http://FederalReporting.gov).

This government-wide reporting requirement focuses on job creation and financial information. In some cases, DOE is also collecting more detailed project management data on a quarterly or monthly basis at an aggregated level. These are related to financial targets, impact metrics, projected milestones, and the number of created or saved jobs and are intended to enhance our ability to measure progress.

### Benefits

**“Developing the next generation of biofuels is key to our effort to end our dependence on foreign oil and address the climate crisis—while creating millions of new jobs that can’t be outsourced. With American investment and ingenuity—and resources grown right here at home—we can lead the way toward a new green-energy economy.”**

– Department of Energy  
Secretary Steven Chu

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For additional information, visit [www.biomass.energy.gov](http://www.biomass.energy.gov).

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